

DIVISION 16
ELECTRICAL

SECTION 16000

ELECTRICAL PROVISIONS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Furnish all labor, materials, and equipment as required by the plans and specifications to provide a complete and workable electrical system. This specification describes the types of materials, methods, and management to be utilized. This includes the work listed in this division as well as equipment furnished under other divisions not specifically mentioned herein.
- B. For Street Light specifications and requirements see Section 16560.

1.02 WORK NOT INCLUDED

Section Not Used

1.03 CODES AND STANDARDS

- A. All equipment, materials, and methods of design and installation are to comply with the National Electrical Code, the basic Electrical Regulations of the State of Utah, the Occupational Safety and Health Act (OSHA), and the requirements of any local codes at the site. Codes and standards of the following organizations may be referred to in this section and shall be considered as the minimum acceptable. A reference herein to any portion of the standard or code is not to be considered as negating any other portion of the standard or code.
 - 1. American National Standards Institute, Inc. (ANSI)
 - 2. Institute of Electrical & Electronic Engineers (IEEE)
 - 3. American Society for Testing & Materials (ASTM)
 - 4. Underwriters Laboratories, Inc. (UL)
 - 5. National Electric Manufacturers Association (NEMA)
 - 6. Insulated Power and Cable Engineers Institute (IPECA)
 - 7. National Electric Code (NEC)
 - 8. Illuminating Engineering Society (IES)
 - 9. Instrument Society of America (ISA)
- B. Where the plans or these specifications require a higher degree of workmanship or quality of material than the above codes and standards imply, then these plans and specifications will prevail.

1.04 EQUIPMENT, MATERIAL AND WORKMANSHIP

- A. All equipment and material is to be new, free from defects, of current manufacture, and listed by Underwriters Laboratories, Inc., (UL) where UL requirements apply. All materials are to be products of reputable and experienced manufacturers. Similar items in the project are to be of the same manufacturer. Use only equipment and materials of industrial quality and durability, and capable of long, reliable, trouble free service.
- B. The Owner reserves the right to operate defective equipment or that equipment which fails to conform to detailed specifications or does not operate satisfactorily until the defects are corrected or the equipment is repaired or replaced, without cost for depreciation, use or wear. Rejected equipment will be removed from operation only at times approved by the Owner.

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All equipment furnished under this section will be guaranteed for a minimum period of one (1) year from date of acceptance against defective materials, design, and workmanship in accordance with the provisions of the contract.

- C. Provide protection for materials and equipment against loss or damage throughout the contract. Protect everything from the effect of weather prior to installation, store items to be installed in indoor location.
- D. Any item subject to corrosion under damp conditions and items containing insulation such as transformers and motors are to be kept in heated locations.
- E. Following installation, protect materials and equipment from corrosion, physical damage and effects of moisture on insulation.
- F. Cap all conduit runs during construction with manufactured seals. Keep openings in boxes or equipment closed.
- G. Layout work carefully in advance.
- H. Do not cut or notch any structural member or building surface without specific approval of the Engineer. Carefully carry out any cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings, pavings, or other surfaces required for the installation, support, or anchorage of conduit, raceways, or other electrical equipment. Following such work, restore surfaces neatly to new conditions using skilled craftsmen of the trades involved at no additional cost to the Owner.
- I. All work will be performed by accomplished, qualified and experienced personnel working under continuous competent supervision.

1.05 PERMITS

Obtain and pay for all permits and inspections pertinent to the electrical installation and obtain such permits from the proper governing body before any progress payment will be certified for electrical work.

1.06 SITE INSPECTION

Prior to submitting a bid, visit the project site and ascertain conditions affecting the proposed work and all existing electrical facilities.

1.07 TEMPORARY INSTALLATION

- A. Temporary installation is to conform to the requirements of the National Electric Code and the State and local governing bodies.
- B. Pay all cost for temporary power services and power usage charges until the project is put into use or is completed.

1.08 UTILITY CONNECTION

Section Not Used

1.09 SHOP DRAWINGS

- A. Make all submittals in accordance with Section 01300.
- B. Within 15 days after the contract award, submit material lists for this section of the work. Lists will include manufacturer and brand name of each class of material.
- C. Submit complete shop drawings for review prior to manufacture of power distribution and control equipment. Drawings will show:
 - 1. Elevations
 - 2. Plan layout and dimensions
 - 3. Construction details

4. Elementary diagrams
5. Connection and interconnection diagrams
6. Bill of Material
7. Finish and name plates
- D. Schematics for all control circuits are to be laid out as a ladder diagram with each line numbered in a sequential manner and all relays having their contact location summary on the line with the relay coil, (per JIC standards). Clearly show and identify interconnection with other systems.
- E. Provide and submit for review complete interconnection diagrams for all equipment showing:
 1. Terminal blocks of all distribution and control equipment
 2. All power, control and signal raceways
 3. Conduit sizes, wire number, wire sizes

1.10 RECORD DRAWINGS

Maintain a neatly marked set of record drawings showing installation location, and/or routing of conduits, depth of buried cables, pull boxes, junction boxes, and outlets. Mark this set to show current job progress and any deviation from the contract drawings. These drawings will be available upon demand of the Engineer. After final inspection, transfer all record information to the Engineer as required in the contract. Failure to keep record drawings up to date will be cause for withholding monthly or final payment.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. The electrical plan drawings show general arrangements and locations for equipment conduit, outlets, etc. Unless detailed or dimensioned, exact locations of conduit, routing of cables and placement of equipment will be governed by structural conditions, physical interference, and locations of electrical termination on equipment. Examine architectural, structural and mechanical plans and shop drawings for the various equipment in order to determine exact routing and placement of all raceways, cables, and equipment, to assure a workable installation.
- B. Allowances have been made in the design for the number of raceways and conductors which the Engineer considers minimum for powering and controlling all electrical equipment. If the installed equipment is of larger horsepower than shown, or if characteristics require increased power and/or conductors, resize the raceway and conductors to allow for the changed conditions and remit the information for review prior to installation.
- C. Be responsible for conduits, cables, and conductors necessary to meet requirements of all electrical equipment and devices. Determine final sizing of conduits and number and size of all required conductors after review of required drawings.

3.02 CLEAN-UP

- A. Continuously remove debris, cuttings, crates, cartons, etc.
- B. Before acceptance, carefully clean all cabinets, panels, boxes, wiring devices, cover plates, etc. Replace all damaged or blemished fixtures.

END OF SECTION

SECTION 16070

ELECTRICAL CONNECTIONS FOR EQUIPMENT

PART 1 GENERAL

1.01 WORK INCLUDED

Provide all labor, materials and equipment as required furnishing connections to all electrical equipment, Lights, etc.

1.02 RELATED WORK

Section 16111 - Conduit

Section 16120 - Wires and Cables

1.03 QUALITY ASSURANCE

- A. NEC COMPLIANCE: Comply with applicable portions of NEC as to type products used and installation of electrical power connections.
- B. UL LABELS: Provide electrical connection products and materials, which have been UL-listed, and labeled.
- C. Comply with applicable portions of the National Electric Safety code as to type products used and installation of electrical power connections.

PART 2 – PRODUCTS

2.01 GENERAL

- A. For each electrical connection indicated, provide complete assembly of materials, including but not necessarily limited to, raceways, conductors, cords caps, wiring devices, pressure connectors, terminals (lugs), electrical insulating tape, heat-shrinkable insulating tubing, high voltage (above 600V.) terminations, cable ties, solderless wire nuts, and other items and accessories as needed to complete splices, terminations, and connections as required.
- B. See Section 16111, Conduit Raceways; Section 16140 Wiring Devices; and Section 16120 Wire and Cables for additional requirements. Provide final connections for equipment consistent with the following:
 - 1. Permanently installed fixed equipment - flexible seal-tite conduit from branch circuit terminal equipment, or raceway; to equipment, control cabinet, terminal junction box or wiring terminals. Totally enclose all wiring in raceway.
 - 2. Movable and/or portable equipment - wiring device, cord cap, and multi-conductor cord suitable for the equipment and in accordance with NEC requirements (Article 400).
 - 3. Other methods as required by the National Electrical Code and/or as required by special equipment or field conditions.

3.01 INSTALLATION OF ELECTRICAL CONNECTIONS

- A. Make electrical connections in accordance with connector manufacturer's written instructions and with recognized industry practices, and complying with requirements of NEC and NECA's "Standard of Installation" to ensure that products fulfill requirements.
- B. Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams. Terminate all low (under 600V.) voltage conductors with Buchanan Terminal Lugs type "Ring Tongue" sized to the appropriate gauges.
- C. Coordinate installation of electrical connections for equipment with equipment installation work.
- D. Verify all electrical loads (voltage, phase, full load amperes, number and point of connections, minimum circuit ampacity, etc.) for equipment furnished under other Sections of this specification, by reviewing respective shop drawings furnished under each section. Meet with each subcontractor furnishing equipment requiring electrical service and review equipment electrical characteristics. Report any variances from electrical characteristics noted on the electrical drawings to ENGINEER before proceeding with rough-in work.
- E. Obtain and review the equipment shop drawings to determine particular final connection requirements before rough-in begins for each equipment item.
- F. Refer to basic materials and methods Section 16120, Conductors, for identification of electrical power supply conductor terminations.

END OF SECTION

SECTION 16111
CONDUIT RACEWAYS

PART 1 - GENERAL

1.01 WORK INCLUDED

Furnish all labor, materials and equipment as required to install all flexible or rigid conduit, couplings, supports and nonmetallic ducts, as shown on the Plans.

1.02 RELATED WORK

- A. Division 2 Site Work Sections
- B. Section 16000 - Electrical Provisions

PART 2 - PRODUCTS

2.01 MATERIALS

- A. GENERAL: Provide metal conduit, and fittings of types, grades, sizes and weights (wall thicknesses) as indicated; with minimum trade size of 3/4".
- B. Electrical Metallic Tubing (EMT): FS WW-C-OS81 and ANSI.
- C. RIGID METAL CONDUIT (RMC): FS WW-C-0581 and ANSI C80.1.
- D. NON-METALLIC CONDUCTOR DUCT (PVC): FS WC-1094A, TC-2(sch.40).
- E. FLEXIBLE METALLIC CONDUIT: Galvanized interlocked steel strip.
- F. LIQUID-TIGHT FLEXIBLE METAL CONDUIT: Provide liquid-tight, flexible metal conduit; constructed of single strip, flexible continuous, interlocked, and double-wrapped steel; galvanized inside and outside; coated with liquid-tight jacket of flexible polyvinyl chloride (PVC).
- G. NON-METALLIC CONDUIT (PVC/PE): Unplasticized polyvinyl chloride/polyethylene heavy wall type 40, suitable for direct burial. Fittings shall be threaded or solvent welded type of same material as conduit. Non-Metallic conduit shall not be embedded in concrete except as specified for runs above 600 volts or as required for grounding conductor installation.
- H. LIQUID-TIGHT FLEXIBLE METAL CONDUIT FITTINGS: FS W-F-406, Type 1, Class 3, Style G.
- I. EXPANSION FITTINGS: OZ Type AX, or equivalent to suit application.

2.02 MATERIALS AND COMPONENTS

- A. Conduit: Street lighting conductors shall be installed in 2" sch. 40 PVC conduit (or approved PE conduit) at a minimum depth of 18" below finished grade, unless otherwise shown on the Plans.
- B. Couplings: Use PVC couplings or liquid tight couplings.
- C. Flexible Conduit: Flexible, plastic-jacketed type with liquid tight connectors.
- D. Nonmetallic Duct: Schedule 40 and Schedule 80 rigid PVC.

2.03 SCHEDULE OF LOCATIONS

- A. Galvanized rigid metallic steel conduit in concrete and in all exposed areas.
- B. EMT for all above grade concealed areas in the building.
- C. Rigid, Schedule 40 PVC/PE conduit elbows with schedule 40 PVC/PE conduit runs on the three-

- phase high voltage (above 600 V.) system. Schedule 40 PVC/PE conduit on the underground low voltage (under 600 V.) system.
- D. Make connections to motors and equipment with PVC jacketed, flexible conduit and liquid tight connectors. Use 1/2-inch minimum size for motor connections.
- E. Use 3/8-inch flexible conduit only for fixture and control wiring in concealed locations. Provide sufficient length of flexible conduit to avoid transmission of sound or vibration.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install conduit concealed in all areas, excluding connections to motors, and connections to surface cabinets.
- B. For exposed runs, attach surface-mounted conduit with channel iron and clamps.
- C. Coordinate installation of conduit in masonry work.
- D. Do not install conduit larger than 2-1/2 inches in concrete slabs. Provide a minimum concrete cover over conduits of two inches.
- E. Install conduit free from dents and bruises. Plug ends to prevent entry of dirt or moisture.
- F. Clean out conduit before installation of conductor.
- G. Alter conduit routing to avoid structural obstructions, minimizing crossovers.
- H. Route all exposed conduits parallel or perpendicular to building lines.
- I. Make interconnections between different types of raceways with manufactured fittings approved by UL.
- J. Size raceways in accordance with NEC tables. Do not reduce from any sizes indicated on the Plans or called out herein.
- K. Do not exceed sizes permitted by Engineer in slabs and/or trenches. Use multiple runs where absolutely necessary.
- L. Do not exceed number of bends allowed in conduit by NEC and reduce such to that indicated or specified when so done.
- M. Make joints wrench tight or otherwise with minimum resistance to the flow of fault currents.
- N. Make field bends only where needed and then carefully to minimize wire pulling tensions and for best appearance in exposed runs.
- O. Test any conduit runs with lignum vitae ball (mandrel) of 85 percent of conduit diameter wherever directed by the Engineer.
- P. Cut conduit with hacksaw or other approved pipe cutting tool and ream ends to clean out all burrs before connecting.
- Q. Keep conduits at least twenty-four inches away from water pipes and at least 12 inches away from gas lines, and in no case permit conductors to reach higher than rated temperatures. Avoid traps in runs and drain conduits wherever practical and wherever indicated.
- R. Fasten raceways securely in place. Firmly fasten conduit within three feet of each outlet, junction box, cabinet, or fitting. Support metallic conduit, rigid (heavy wall) and EMT at least every ten feet. Support rigid nonmetallic conduit in strict accordance with Table 347-8 of NEC. Use raceway fasteners designed for the purpose.

3.02 LOCK NUTS, BUSHINGS, CONNECTORS AND COUPLINGS

- A. Use "double-locknut" system (2 locknuts) throughout, each being tightened wrench tight as to effectively bond outlet box or cabinet to conduit.
- B. Use malleable bushings, except that plastic bushings may be used in lieu of phenolic-lined malleable bushings where "insulating bushings" are required per NEC.
- C. Use insulated-throat type ground bushings of the malleable type, fully equal to T & B #3802

series.

- D. Use connectors and/or couplings that are proper for the conduit they are used with. Make watertight in all trenches.
- E. Use cadmium plated or galvanized fittings.
- F. Provide fittings with die-cut threads unless approved otherwise.

3.03 CONDUIT OUTLET BODIES

- A. Manufacturers/Types: Where indicated and/or where desirable, make conduit installations using cast iron or cast aluminum outlet bodies equal to Crouse-Hinds "Condulets," Appleton "Unilets," or Pyle National "Pylets." Use fitting appropriate for location and usage. Use in combination with factory or field bends when indicated, and/or when advised.
- B. Complete outlet bodies with gaskets, covers, hubs, reducers, and other accessories.
- C. Finish: Cadmium or equal, of steel. If only aluminum, they shall be essentially "copper-free." Do not use on conduits of dissimilar metals, except with written permission of the Engineer.

3.04 SPECIAL CONDUIT FITTINGS

- A. Use special conduit fittings as required and/or indicated. Use UL approved fittings suitable for locations and usage made.
- B. At expansion joints, use special fittings equal to "EXDA," "AX," or "EX" as made by O-Z Electrical Manufacturing Company if cast in concrete slabs.
- C. Building Expansion Joints: Where surface conduits, raceways, panels, or light fixtures, span building expansion joints, make satisfactory arrangements to provide the movement provided for in building structure + nominal joint width.

3.05 PULL BOXES, WIREWAYS AND GUTTERS

- A. Furnish as shown on the plans, plus any such items required to assemble conduits and other raceways. Provide pull boxes as dictated by wire pulling requirements. Unless shown otherwise, face into secondary or unfinished rooms.
- B. Construction: Code gage galvanized sheet steel and sized strictly in conformance with NEC requirements.
- C. Manufacturers:
 - Alwalt
 - Keystone
 - Square D
 - Associated Plastics
- D. Finish: Free of burrs, sharp edges, unreamed holes, and sharp-pointed screws or bolts. Paint where indicated on the Plans, both inside and out.
- E. Coating: When mounted direct to concrete or masonry walls that are below grade and/or where there will be sweating or other moisture present on wall surface, coat backs of boxes with a heavy coat of black asphalt paint before mounting.
- F. Protection: Adequate provisions for preventing damage to conductors either during pulling-in or from weights and tension when in place.
- G. Weatherproof, rain-tight, or special type when indicated and/or when required by NEC.

3.06 ANCHORS, FASTENERS AND MISCELLANEOUS SUPPORTS

- A. Use compatible anchors in roof or ceiling slabs of concrete from which a load is suspended and anchors used to fasten heavy equipment without lead in their construction. Use anchors equal to Rawl "Sabertooth" or equal to Arro 2000 series (Ace), 2500 series (Double), 3000 series (O-E), or 3500 series (Hold-it).
- B. Make exposed conduit fastenings with one-piece, malleable conduit clamps equal to Appleton, Steel City, or Gedney. Two-hole, galvanized sheet metal pipe straps may be substituted only upon application to the Engineer, but may be used on all concealed installations.
- C. Use companion bases or backs with conduit clamps when conduit is exposed to weather or continuous moisture.
- D. Use ring type hangers on individual runs or conduit three inches and larger if suspended, equal to Grinnel #107R or 101 series, complete with threaded rods. Use adjustable turnbuckles when specified or otherwise as an option.
- E. Support multiple runs of suspended conduits from trapeze type hangers made up of one or more cross channels of Unistrut, Powerstrut, or Kinsdort Channel, suspended with rigid threaded steel rods and with suitable conduit clamps or straps of the same make as cross channels used.
- F. Mount multiple runs of conduit on ceiling or wall surfaces, on surface of flush Unistrut channel.
- G. Fabricate supports for switchgear, transformers and similar electrical equipment from these same channel types, or if of lighter weight, from galvanized slotted angles equal to "AIM" or "Rapidsteel."
- H. Whenever vibration absorbing supports are indicated or required, they shall be equal to Korfund "Elasto-Rib" or to Lowell Industries "Vibra-Check."
- I. Support of Electrical Equipment and Materials: Do not hang or support electrical equipment and materials from roof decks.

3.07 COLOR CODING

- A. Provide color bands one inch wide for conduits up to two inches in diameter and one-half the conduit diameter for larger conduits applied at panel and pullbox locations within each room and 50 feet on centers within an area.
- B. Color Banding:
 - 1. 120/208 volt: gray
 - 2. 347/600 volt: sand
 - 3. Fire alarm: red
 - 4. Telephone: blue
 - 5. Intercommunication and Sound: yellow
 - 6. 7200/12,470 volt: black
 - 7. Low voltage switching: black

PART 4 - MEASUREMENT & PAYMENT

4.01 MEASUREMENT AND PAYMENT

No separate measurement or payment will be made for conduit. Include costs in other items of work.

END OF SECTION

SECTION 16120
LOW VOLTAGE WIRES AND CABLES

PART 1 - GENERAL

1.01 WORK INCLUDED

Furnish all labor, materials and equipment as required to install all wires and cables as shown on the Plans, and as required to connect all electrical services and equipment.

1.02 RELATED WORK

- A. Section 16000 - Electrical General Requirements
- B. Section 16111 - Conduit

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Acceptable Manufacturers:
 - 1. As noted for individual items.
 - 2. Other manufacturers desiring approval comply with Section 01640.
- B. Branch Circuit Wiring: Conductors smaller than No. 12 AWG gage not permitted, except No. 14 AWG gage for 24 volt maximum control circuits.
- C. Provide permanent plastic name tag indicating load fed.
- D. Use type THHN (or equal approved by Engineer) conductors in sizes shown on the plans for all branch circuits, and control circuits.

2.03 WIRE AND CABLE MANUFACTURERS

- A. Approved Wire and Cable Manufacturers:
 - General Electric
 - Okonite
 - Anaconda
 - General Cable
 - Simplex
 - Rome
 - Cerro
 - ANIXTER
 - Or equal approved by Engineer.

3.01 INSTALLATION

- A. Make conductor length for parallel feeders identical.
- B. Lace or clip groups of feeder conductors at distribution centers, pullboxes, and wireways.
- C. Provide copper grounding conductors and straps.
- D. Install wire and cable in code conforming raceway.
- E. Use wire pulling lubricant for pulling No. 4 AWG and larger wire.
- F. Install wire in conduit runs after concrete and masonry work is complete and after moisture is swabbed from conduits.
- G. Install communication cable in trench as noted in detail on the plans.
- H. Communication cable shall be marked and coiled in the lengths specified within 5' of future facilities. Protect coiled cable from damage incurred during construction of future facilities.
- I. Color code conductors to designate neutral conductor and phase.
- J. Furnish necessary reels, reel jacks, and other pulling aids required to prevent damage to wires and cable.
- K. Identify conductors with pressure sensitive tags as manufactured by Brady or approved equal.
- L. Install wires and cables continuous without splices from source of supply to distribution equipment and from source of supply to motors, lighting, or power outlets. Do not use pull boxes for making splices. Do not install splices in conduits or trench.
- M. Install all wiring in accordance with NEC standards.

3.02 CONDUCTOR CONNECTIONS

- A. Use approved pressure type solderless connectors and lugs for high voltage terminations, service entrance, feeder, and equipment connections.
- B. Use connectors equal to Elastimold, 3M Burndy, T & B, O-Z, or Penn Union, and of a type compatible to conductors, location and load.
- C. Make neutral connections and taps individually in order to prevent the possibility of an "open-neutral."
- D. Make branch circuit connections with UL approved solderless connectors equal to Buchanan, Scotch, or T & B. Use fixture connections equal to those made by same manufacturers. Do not depend solely upon a single insulating material to secure connection as well as to insulate it.
- E. Solder joints using Kester 50-50 solder and approved soldering paste equal to Nokorode will be acceptable in lieu of mechanical pressure or solderless types for branch circuit and fixture connections.
- F. Bolt bus bar connections with adequate nonferrous bolts, washers, and lockwashers, after first either silverplating the bars or applying suitable non-oxidizing agents equal to No-Oxide.
- G. Perform lug and/or bus bar drilling in accordance with applicable ASA/NEMA Standards. Use connection bolts or screws made of bronze, copper, brass, or of adequately plated nonferrous material.

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- H. Insulate joints and taps with patented or molded plastic or insulators, or suitably with Okonite or 3M tapes. Use tapes compatible with conductor jackets, temperature, and other conditions.

3.03 SPECIAL WIRING

Special Systems: Furnish and install equipment, materials, labor, services, and accessories required for completion of any special systems of an electrical nature, but not classified otherwise herein, that may be indicated on the Plans and/or herein. Applicable portions of NEC also apply.

3.04 HAZARDOUS AREA

- A. Hazardous Locations: Strictly comply to NEC Articles 500-517 when installing wiring, fixtures and equipment in locations classified as "Hazardous Locations."
- B. Notify Engineer immediately of any suspected discrepancies between NEC requirements and specified or indicated installation.

PART 4 - MEASUREMENT & PAYMENT

4.01 MEASUREMENT AND PAYMENT

- No separate measurement or payment will be made for low voltage wires and cables. Include costs in other items of work.

END OF SECTION

SECTION 16121

WIRE CONNECTIONS AND DEVICES

PART 1 – GENERAL

1.01 WORK INCLUDED

- A. Provide wire connectors, crimp terminals, splice connectors, mechanical lugs, compression lugs, pin connectors, split bolt connectors and associated insulating devices for a complete wiring connection system suitable for specified cables furnished.
- B. Connectors shall be in accordance with NEC, state and local requirements for size and color installed therein.

PART 2-PRODUCTS

2.01 MATERIALS, WIRE CONNECTORS, AND WIRE NUTS

A cone-shaped, steel-plated, coil spring insert within an insulating connector body containing buttress threads inside the skirt for guiding wire ends snugly into body skirt.

2.02 CRIMP NUTS

- A. Insulated and noninsulated open end steel connector with flared entry for easy wire insertion and a secure crimp connection.
- B. Insulated nut provided to have resilient nylon insulation for ruggedness.

2.03 CRIMP TERMINALS

- A. Insulated terminal with brazed seam to prevent splitting.
- B. Electrolytic copper uniformly electro-tin plated to resist corrosion.
- C. Color-coded insulation for identification of proper size.
- D. Insulation shall be of resilient nylon.

2.04 SPLICE CONNECTORS

Provide with same qualities as terminals.

2.05 MECHANICAL LUGS

- A. Dual rated solderless lug for use with aluminum and/or copper conductors.
- B. Lugs shall be rated at 600 volts.
- C. Lugs shall be constructed of electro-tin plated high strength aluminum alloy.

D. Lugs may range in size from single conductor barrel to eight (8) barrels.

2.06 COMPRESSION LUGS

- A. Dual rated seamless lug for use with aluminum and copper single conductor barrel.
- B. Lugs shall be rated at 600 volts.
- C. Lugs shall be constructed of electro-tin plated high strength aluminum alloy.
- D. All compression lugs to be rung type on control wiring.

2.07 SPLIT BOLTS

- A. Strong corrosion resistant tin plated high strength copper alloy for both aluminum and copper conductors.
- B. Each bolt shall have wire separator.
- C. Bottom pad attached to nut and guide assembly.

2.08 MANUFACTURERS

- Ideal Industries.
- 3-M Company.
- Buchanan.
- Mac Products.
- IlSCO.
- Or equal approved by Engineer.

PART 3-EXECUTION

3.01 WIRE CONNECTORS

- A. Wire nuts and noninsulated crimp nuts shall be used in branch circuit power and lighting wiring.
- B. Insulated crimp nuts may be used in lighting fixtures, appliances, and control wiring.

3.02 CRIMP TERMINALS

Insulated crimp terminals shall be used in making wire to device connections for control/instrumentation wiring.

3.03 SPLICE CONNECTORS

Insulated splice connectors shall be used for splicing control wires only when splicing is indicated on the Drawings.

3.04 MECHANICAL LUGS

Mechanical lugs shall be used for making connections to electrical equipment such as disconnect switches, panelboards, transformers, switchboards and motor control centers.

3.05 COMPRESSION LUGS

Compression Lugs shall be used in lieu of mechanical lugs when mechanical lugs are not provided.

3.06 SPLIT BOLTS

- A. Split bolts shall be used in making feeder taps in junction boxes and wireways where conductors are solid No. 10 CU and larger.
- B. Connections shall be insulated and rated at 600 volts at 90oC.

3.07 INSTALLATION

- A. All connectors and lugs installed shall not exceed manufacturer's recommended connecting combinations.
- B. Install wire connecting devices to provide for a tight mechanical and electrical make-up.
- C. Recheck splices and terminations and makeup tight prior to substantial completion.

END OF SECTION

SECTION 16122

PRIMARY HIGH VOLTAGE CABLE

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. These specifications cover the construction, mechanical and electrical requirements for aluminum conductors insulated with either tree-retardant XLP or EPR for operation at 15 KV phase to phase.
- B. The cable is intended for operation at 60 HZ single phase or three-phase and shall be suitable for operation in ducts or direct buried installations in earth, for wet and dry locations, and in open air in sunlight.
- C. The cable shall be manufactured by the triple extrusion process wherein the three core layers - conductor shield, insulation and insulation shield - are successively extruded in one pass and simultaneously dry (nitrogen gas) cured.

1.02 RELATED WORK:

- A. Division 2 Site Work Sections
- B. Section 16000 - Electrical Provisions
- C. Section 16111 – Conduit Raceways
- D. Section 16120 - Low Voltage Wires and Cables

1.03 CODES AND STANDARDS

The cable shall be in compliance with the requirements of this specification and the applicable requirements of the following Industry Standards.

- 1. ICEA S-68-516/NEMA WC7-1982, or latest revision for Ethylene Propylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy."
- 2. AEIC CS5-87 or latest revision, "Specifications For Thermoplastic and Crosslinked Polyethylene Insulated Shielded Power Cables Rate 5 through 35kv."
- 3. ASTM Designation B230 for Hard Drawn Aluminum Conductors.
- 4. ASTM Designation B231 for Concentric Lay Stranded Aluminum Conductors.
- 5. ASTM B609 for Aluminum 1350 round wire, Annealed and Intermediate Tempers for Electrical Purposes.
- 6. ASTM B3 for Soft or Annealed Copper Wire.

PART 2 - PRODUCTS

2.01 MATERIALS AND COMPONENTS

A. Acceptable Manufacturers

- Cablec
- Hendrix
- BICC
- Okonite
- Approved equal by Engineer

B. Product Requirements:

1. The cable shall meet the requirements of ICEA S-68-516 and AEIC CS5 latest edition except where it conflicts with the requirements of this specification, in which case this specification shall apply.
2. **CENTRAL CONDUCTOR:** Stranded Conductor shall be class B concentric lay compressed aluminum strand in accordance with ASTM B231.
3. **CONDUCTOR SHIELDING:** The conductor shield shall be extruded semiconducting ethylene propylene meeting the requirements of ICEA S-68-516, paragraph 2.7. Thickness of the strand shield shall be in accordance with AEIC CS4-87, Table C.1. The shield shall be bonded to the insulation and strip freely from the conductor.
4. **INSULATION:** The insulation shall be tree-retardant cross-linked polyethylene or ethylene propylene rubber and shall meet the requirements of ICEA S-68-516, Part 3. Insulation thickness shall be as specified in Table B.1 Column B, for 133% insulation level as specified in the inquiry.

The insulation shall be suitable for use in wet or dry locations at conductor temperatures not to exceed 90 C for continuous operation, 130 C for emergency overload conditions and 250 C for short-circuit conditions in accordance with AEIC CS5, Section A, and ICEA S-68-516, part 3.

The insulation compound shall be extra clean and stored in a contamination free bulk handling system to maintain cleanliness prior to conveyance and use in the extruder.

5. **INSULATION SHIELDING:** The insulation shield shall be an extruded semiconducting thermoset polymer meeting the requirements of paragraph 4.1.1 of ICEA S-68-516, part 3. The shield compound shall be compatible with the insulation and identified as semiconducting by surface printing. The shield thickness shall be in accordance with Table C.2 in AEIC CS5-87 and the stripping tension shall meet the requirements of paragraph D.1 except stripping tension shall not be less than 10 pounds.
6. **METALLIC SHIELDING:** Concentric neutral wires or tape shielding shall be bare, soft, annealed copper wires helically applied over the insulation shield and uniformly spaced. The metallic shielding shall have full equivalency of the phase conductor for single-phase applications and at least 1/3 equivalency of the phase conductor for three-phase applications.
7. **OVERALL JACKET:** An outer jacket of black linear low density high molecular weight polyethylene shall be extruded so as to embed and cover the neutral wires. The minimum average thickness over the neutral wires shall be not less than 50 mils for calculated cable

diameters over the concentric neutral of 1.5 inches or less, and 80 mils for over 1.5 inches. The jacket shall strip freely from the insulation shield, but not necessarily from the wires. A suitable and compatible release agent may be used to prevent adhesion to the insulation shield.

C. CABLE IDENTIFICATION:

The outer surface of each cable shall be durably marked throughout its length in accordance with AEIC CS5-87, paragraph H. Sequential footage numbers shall be clearly printed throughout the cable length at two foot intervals. Year manufactured, manufacturer and plan number to be clearly printed the entire cable length.

D. TEST REQUIREMENTS:

Each length of cable shall be tested in accordance with AEIC CS5-87 with the following exceptions:

1. Apparent Discharge Test shall be performed in accordance with AEIC CS5-87 except the maximum discharge of 5 picocoulombs to full test voltage of 200 volts/mil.
2. A.C. Voltage Withstand Test shall be performed in accordance with AEIC CS5-87 except partial discharge to be monitored during test. If partial discharge appears, cable is to be rejected.
3. D.C. Voltage Withstand Test shall be performed in accordance with AEIC CS5-87 except at 400 volts/mil.

E. PACKAGING AND MARKING:

1. The cable shall be furnished in cutting lengths as single conductor.
2. The reels shall be substantially constructed non-returnable wood reels to safely carry the weight of the cables. Each reel of cable shall be protected with NEMA Class 2 covering. The bottom and top cable ends shall be properly secured to the reel.
3. There shall be no water or corrosion in the standard conductor of the completed cable when reel is shipped. Each end of cable shall be capped and sealed watertight to prevent the entrance of moisture into the cable during transit or outdoor storage.
4. Reels shall be non-returnable, double layered, wood flanged type, substantially constructed to afford proper protection of the cable during shipment and handling. Reels shall have a minimum outside drum diameter not less than prescribed in ICEA A-9-428, for each cable type.
5. Each reel shall be marked with a weather-resistant label. securely attached to a flange of the reel and plainly stating the destination, purchaser's factory production lot identification number, date of manufacture, description of cable, length of cable on reel, and gross and tar weight of reel.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. All three-phase, #2, 15kV primary circuit conductors shall be installed in conduit raceway systems.

- B. Provide grounding on all concentric neutrals as shown on the plans.
- C. Do not exceed 800 lbs. of tension when pulling high voltage cable through the conduit systems. Only pulling systems which are standard to the Utility Industry shall be permitted and approved by the Engineer. The Engineer shall be on site during the pulling and termination of high voltage cable.

3.02 CONDUCTOR CONNECTION

- A. All high voltage underground cable in transformers, vaults, and sectionalizers shall be terminated with 15KV class, 200 AMP, Loadbreak Elbow Terminations with test point.
- B. The cable installed on the riser pole shall be terminated with 15KV class, molded Termination Kits suitable for raintite/outdoor installation.

PART 4 - MEASUREMENT & PAYMENT

4.01 MEASUREMENT AND PAYMENT

No separate measurement or payment will be made for primary high voltage cable/concentric neutral URD. Include costs in other items of work.

END OF SECTION

SECTION 16130

PULL AND JUNCTION BOXES

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Construct junction or pull boxes less than 100 cubic inches as "standard outlet boxes".
- B. Construct junction or pull boxes greater than 100 cubic inches as "cabinets".
- C. Provide all covers of same gauge metal and include screws.

1.02 QUALITY ASSURANCE

REFERENCE STANDARDS:

- NEMA.
- NEC.
- U.L. labels required.

PART 2 - PRODUCTS

2.01 EQUIPMENT

2.02 STANDARD OUTLET BOXES

- A. Make of material resistant to corrosion or suitably protected, both internally and externally by galvanizing.
- B. Boxes installed in damp or wet locations shall be U.L. approved for the purpose.
- C. Comply with U.L. Standard 50.
- D. Metal boxes to meet NEC construction specifications.
- E. Boxes exposed or surface mounted shall be die-cast or permanent- mold cast aluminum body with threaded external hub and cast cover.

2.03 CABINETS

- A. 14 gauge sheet steel with corrosion resistant finish.
- B. Ample space for wires, connections and equipment.
- C. Provide with door, flush catch and lock.
- D. Key all locks alike; coordinate keying with engineer.

- E. Furnish five (5) keys to the OWNER.
- F. Include suitable devices for securing, supporting and adjusting panel-board interiors and fronts.
- G. Cabinet fronts: Sheet steel panels with hinged door.
- H. Flush cabinets: Approximately $\frac{3}{4}$ inches larger than cabinet on all sides, set with front firmly against the finished wall surface.
- I. Telephone cabinets: Size and depths as noted on Drawings, with wood backboards.

PART 3 – EXECUTION

H.01 INSTALLATION

- A. Install junction boxes so that covers are readily accessible after the completion of the installation.
- B. Do not embed junction boxes made of aluminum in concrete.
- C. Mount rigidly in place with fronts straight and plumb.
- D. Support sheet steel boxes adequately to maintain shape.
- E. Secure covers with corrosion resistant screws or bolts.
- F. Center cabinet interiors in door opening.
- G. Provide each pull box, including boxes above switchboards and motor control centers, with sufficient clamps to which cables shall be secured in neat and orderly fashion permitting ready identification.
- H. Mount pull boxes connected to concealed conduits with covers flush with the finished wall.

END OF SECTION

SECTION 16132

15KV PADMOUNTED SECTIONALIZING AND SWITCHGEAR ASSEMBLIES

PART 1 – GENERAL

1.01 WORK INCLUDED

- A. Furnish all labor, materials, and equipment to provide and install the 15 KV sectionalizing equipment and switchgear assemblies, as shown on the plans.
- B. Install the sectionalizers on compacted earth. Refer to compaction standards for roadways.

1.02 RELATED WORK

- A. Division 2 Site Work Sections
- B. Section 16000 - Electrical Provisions
- C. Section 16111 – Conduit Raceways
- D. Section 16122 - Primary High Voltage Cable
- E. Section 16402 - Electrical Distribution System, Underground

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Manufacturer and Type: S&C, Maysteel, Malton
- B. Substitutions: Approved prior to bidding by Engineer.

2.02 EQUIPMENT RATING

- A. Outdoor Style, Manual Operation are as follows:

KV, Nominal	14.4
KV, Maximum Design.....	17.0
KV, BIL.....	95
Main Bus Continuous, Amperes	600
Three-Pole Interrupter Switches	
Continuous, Amperes (Source/Feeder).....	600
Live Switching, Amperes (Source/Feeder).....	600
Two-Time Duty-Cycle Fault-Closing, Amperes Rms Asymmetrical.....	23,400
Fuses with integral Load Interrupter	
Maximum, Amperes 200E or as shown on the plans	
Live Switching, Amperes.....	200
Two-Time Duty-Cycle Fault-Closing Capability, Amperes Rms Symmetrical.....	12,500

Short-Circuit Ratings

Amperes, Rms Symmetrical12,500
Mva Three-Phase Symmetrical at
Rated Nominal Voltage180

2.03 EQUIPMENT COMPONENTS

- A. The momentary and two-time duty-cycle fault-closing ratings of switches, momentary rating of bus, interrupting ratings of fuses, and one-time duty-cycle fault-closing capabilities of the fuses with integral load interrupters shall equal or exceed the short-circuit ratings of the pad-mounted gear.
- B. The pad-mounted gear shall consist of a single self-supporting enclosure, containing single blade interrupter switches, non-key interlock; dual purpose barriers for the switches and fuses.
- C. The switches and fuse components shall be arranged for full visibility when the enclosure doors are open. Open switch gaps and blown-fuse indicators shall be readily visible to provide for ease of operation.
- D. Interrupter switches shall have a two-time duty-cycle fault-closing rating equal to or exceeding the short-circuit rating of the integrated pad-mounted gear assembly. This rating defines the ability to close the interrupter switch twice against a three-phase fault with asymmetrical current in at least one phase equal to the rated value, with the switch remaining operable and able to carry and interrupt rated current. Tests substantiating this rating shall be performed at maximum design voltage with current applied for at least 10 cycles. Certified test abstracts establishing this rating shall be furnished upon request.
- E. Interrupter switches shall have the capability established by test to perform switching duties which include interrupting load current up through the assigned live-switching rating, as well as transformer magnetizing currents associated with the applicable loads, and cable-charging current and line-charging current typical for distribution systems of the applicable voltage ratings. All arcing accompanying interruption shall be contained within the interrupters, and arc products and gases evolved during interruption shall be vented through exhaust-control chambers to eliminate discharge of ionized gases. Switches shall have a single blade per phase and shall be externally operable. A quick-make, quick-break mechanism, nondefeatable under normal operation, shall make operation of the switch blades independent of the speed of the manual operating handle.
- F. Solid-material power fuse shall be capable of detecting and interrupting all faults up to the short-circuit interrupting rating of the integrated pad-mounted gear assembly. Fusible elements shall be nonaging and non-damageable. All arcing accompanying power fuse operation shall be contained within the fuse, and all arc products and gases evolved shall be effectively contained within exhaust control devices during fuse operation. Power fuse shall have a blown-fuse indicator that shall be readily visible without removing the fuse from the mounting. Fuse type shall be S & C Type SM-4 for system compatibility.
- G. Fuse mounting jaw contacts shall be equipped with integral load interrupter to permit live switching of fuses with a hookstick. Integral load interrupters shall have a one-time duty-cycle fault-closing capability equal to the short-circuit rating of the pad-mounted gear. The duty-cycle capability defines the level of available fault current

into which the fuse can be closed without a quick-make mechanism and when operated vigorously through its full travel without hesitation at any point, with the integral load interrupter remaining operable and able to carry and interrupt currents up to the emergency peak-load capabilities of the fuse.

- H. Mounting Pad for Model PMS (Pad Mounted Switches).
Provide an integrated designed one-piece mounting base for each model specified. Unit to be Concast or equal, 20" deep complete with threaded anchor studs strategically located to clip anchors per installation instructions.

PART 3 EXECUTION

INSTALLATION

- A. Prepare Conduits and Primary Cable for placement of Ground Sleeve.
- B. Place Ground Sleeve on compacted soil as required for compaction of roadways.
- C. Install sectionalizer or switchgear and connect all Primary High Voltage Cable.
- D. Install grounding as shown on the plans.

END OF SECTION

SECTION 16170

GROUNDING AND BONDING

PART 1 - GENERAL

1.01 SECTION INCLUDES

Grounding electrodes and conductors, equipment grounding conductors and bonding.

1.02 REFERENCES

- A. ANSI/NFPA 70 - National Electrical Code.
- B. IEEE/ANSI 142-Latest edition - Recommended Practice for Grounding of Industrial and Commercial Power System.

1.03 PERFORMANCE REQUIREMENTS

Grounding System Resistance: 2 ohms.

1.04 SUBMITTALS

- A. Product Data: Provide data for grounding electrodes and connections.
- B. Test Reports: Indicate overall resistance to ground.
- C. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation and installation of exothermic connectors.

1.05 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of contract documents.
- B. Accurately record actual locations of grounding electrodes.

1.06 QUALIFICATIONS

Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years experience.

1.07 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by testing firm acceptable to the Town as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.01 ROD ELECTRODE

- A. Material: Copper-clad steel.

- B. Diameter: 3/4 inch minimum.
- C. Length: 10 feet minimum. Rod shall be driven at least 9' 6" deep.
- D. Provide the number of rods required to obtain proper ground resistance. This applies to manholes, padmount switches, transformers, service entrances, etc.

2.02 MECHANICAL CONNECTORS

- A. The mechanical connector bodies shall be manufactured from high strength, high conductivity cast copper alloy material. Bolts, nuts, washers and lockwashers shall be made of Silicon Bronze and supplied as a part of the connector body and shall be of the two bolt type.
- B. Split bolt connector types are NOT allowed.
- C. The connectors shall meet or exceed UL 467 and be clearly marked with the catalog number, conductor size and manufacturer.

2.03 COMPRESSION CONNECTORS

- A. The compression connectors shall be manufactured from pure wrought copper. The conductivity of this material shall be no less than 99% by IACS standards.
- B. The connectors shall meet or exceed the performance requirements of IEEE 837, latest revision.
- C. The installation of the connectors shall be made with a compression, tool and die system, as recommended by the manufacturer of the connectors.
- D. The connectors shall be clearly marked with the manufacturer, catalog number, conductor size and the required compression tool settings.
- E. Each connector shall be factory filled with an oxide-inhibiting compound.

2.04 EXOTHERMIC CONNECTIONS

- A. WIRE:
 - 1. Material: Stranded copper(aluminum not permitted).
 - 2. Grounding Electrode Conductor: Size as shown on drawings, specifications or as required by NFPA 70, whichever is larger.
- B. BUS
 - 1. Material: Copper(aluminum not permitted).
 - 2. Size: 1/4" X 2" minimum.

PART 3 EXECUTION

3.01 EXAMINATION

Verify that final backfill and compaction has been completed before driving rod electrodes.

3.02 GENERAL

- A. Install Products in accordance with manufacturer's instructions.
- B. Mechanical connections shall be accessible for inspection and checking. No insulation shall be installed over mechanical ground connections.
- C. Ground connection surfaces shall be cleaned and all connections shall be made so that it is impossible to move them.
- D. Attach grounds permanently before permanent building service is energized.
- E. Install rod electrodes at locations indicated or as required by Code, whichever requires the most rods. Install additional rod electrodes as required to achieve specified resistance to ground.
- F. Provide bonding to meet Regulatory Requirements.
- G. Bond together metal siding not attached to grounded structure; bond to ground.
- H. All separate ground wires shall be enclosed in rigid galvanized steel conduit and bonded at both ends to the rigid galvanized steel conduit with an approved fitting.

3.03 MEDIUM VOLTAGE SYSTEM GROUNDING

- A. Provide ground rods as shown on drawings for high voltage switchgear. Connect to ground bus with 1/0 copper. Exothermic connection shall be made between conductor and ground rod.
- B. Provide separate 1/0 copper conductor from ground bus to:
 - 1. XO terminal of each transformer.
 - 2. Each high voltage switch ground bus.
 - 3. Secondary service equipment ground bus.
 - 4. Transformer high voltage grounded terminal (if required).
- C. Provide full size 600V copper THW, THHN, THWN or XHHW grounding conductor in each conduit, raceway or enclosure which contains high voltage conductors. Terminate at ground bus of equipment containing high voltage terminations. Connect to ground rod and present grounding conductors in manhole.
- D. Bond each enclosure containing high voltage parts (switches, fuses, transformers, all junction boxes, etc.) to room ground bus with 1/0 copper conductor.
- E. Bond all conduits containing high voltage conductors or secondary service conductors to penetrated enclosures using grounding bushing and #4 copper conductor. Attach to penetrated enclosure using compression lug on stud or bolt and Belleville washers.

- F. Bond all conduits carrying individual grounding or grounding electrode conductors with grounding bushing and separate #4 copper grounding conductor to ground bus.
- G. Provide #10 stranded wire from each termination shield drain wire to ground bus within enclosure. Connect to nearest grounded conductor if ground bus is not within 24". Route shield drains away from energized parts. Make connections with "Sta-Kon" type terminals or tool applied tap connectors.
- H. Provide ground rod in each section of each secondary switchboard. Make Exothermic or UL Listed Mechanical connection between 1/0 copper to ground rod and to switchgear ground bus.

3.04 FIELD QUALITY CONTROL

- A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.
- B. Measure ground resistance from system neutral connection at service entrance to convenient ground reference point using suitable ground testing equipment. Resistance shall not exceed 2 ohms.

END OF SECTION

SECTION 16551

EXTERIOR AREA LIGHTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

Drawings and general provisions of Contract apply to work of this section.

1.02 DESCRIPTION OF WORK:

- A. Extent of exterior area lighting work is indicated by drawings.
- B. Refer to Division 2 for Site Work Sections.
- C. Refer to other Division 16 sections for cable, wire, and connectors required in connection with exterior area lighting poles and standards.

1.03 QUALITY ASSURANCE:

- A. Comply with NEC, NEMA and ANSI/IES requirements as applicable to location and Installation of lighting poles and standards. Provide lighting components and fittings which are UL-listed and labeled.
- B. Comply with other portions of specification as applicable for forming, splicing, and curing of concrete bases provided under this section.

1.04 SUBMITTALS:

Product Data: Submit manufacturer's data on lighting units, including certified dimension drawings of components including, but not necessarily limited to, poles and standards, mast arms, brackets, hardware and fixtures.

PART 2 - PRODUCTS

2.01 MANUFACTURER: Subject to compliance with requirements, provide products as scheduled on drawings.

2.02 FUSES: Provide (3) spare fuses for each type and size used.

2.03 CONCRETE: 3000 psi Class.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Install area lighting units as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC, NESC, and NEMA standards, and with recognized industry practices to ensure that lighting units fulfill requirements.

- B. Comply with NEC 300-5 (or State of Utah requirement, whichever is most stringent), for raceway burial depth.
- C. Mount lighting units on concrete bases as indicated, complete with anchor bolts and reinforcing bars. Coordinate proper size and location of all bases as required to insure proper installation. Provide 3000 psi class concrete; hand rub all exposed concrete to uniform, smooth finish. Grout the spacing between the pole base plate and the concrete base. Provide a base cover to conceal the bolts, of the same material and color as the pole.
- D. Use belt slings or rope (not chain or cable) to raise and set finished poles and standards to protect finish. Repair nicks and scratches to original surface appearance.
- E. Set poles and standards plumb. Support adequately during backfilling, or anchoring to foundations.
- F. Provide sufficient space encompassing hand access and cable entrance holes for installation of underground cabling.
- G. Provide Bussman HEB fuseholder (or Liftelfuse LEB-XX-S) with "breakaway" receptacles in all conductors running to the top of each pole. Locate fuseholder at hand hole or in base junction box as applicable. Provide KTK fuses in each phase conductor, sized 1.5 times maximum full load current of ballasts served by each conductor. Do not exceed rating of circuit overcurrent protective device. Provide fuse blanks in neutral conductors. Make up all other splices in pole or pole base using Scotchcast 400 Resin for watertight connection.

3.02 GROUNDING:

Provide equipment grounding connections for each lighting unit installation.

END OF SECTION

SECTION 16560
STREET LIGHTING

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Concrete base installation.
- B. Light Pole installation.
- C. Light fixture installation.
- D. Conduit.
- E. Wire installation.
- F. Fuse installation.
- G. Grounding and bonding.
- H. Junction Boxes (J-Boxes).
- I. Warranty.

1.02 RELATED WORK

- A. Section 03000 - Concrete Work.
- B. Section 03200 - Concrete Reinforcement.
- C. Section 03300 - Cast-In-Place Concrete.

1.03 QUALITY ASSURANCE

- A. Comply with federal, state and local electrical codes and regulations.
- B. Materials and workmanship for street light construction shall be in accordance with applicable governing authority.
- C. Only workers commercially licensed as Electrical Contractors shall be used in performing the work.

PART 2 - PRODUCTS

2.01 LIGHT POLES

- A. Residential:
 - Pole shall be a tapered aluminum pole with a wall thickness of 0.125 inches.

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- Surface coating of 1.5 mil black semi-gloss coating with a minimum of 5 (five) year warranty.
- Bottom 4 (four) foot of pole shall have an additional 8 mil (min), coating for corrosion protection. High build epoxy or a PVC wrap will be allowed.
- Hand hole shall have an aluminum reinforcing frame to maintain the poles structural integrity.
- The aluminum hand hole cover shall be fastened by stainless steel hardware.
- An electrical grounding lug shall be provided near the opening for easy wire attachment.

B. Arterial:

- Pole shall be made of steel with a 48,000 PSI minimum yield after fabrication.
- Pole shall be 30 feet tall with a constant linear taper, 8" O.D. at the base and 4" O.D. at the top with a 0.5" tolerance.
- Pipe truss luminaire arms shall be made from 2" schedule 40 pipe with connection spacing at 27.5".
- Connection shall allow arm to be erected and held in place by gravity and secured by four bolts.
- Arms shall have a rise of no more than 3 (three) feet.
- Pole, arm, and fasteners shall have 1.5 mil (min.) black semi-gloss coating with a minimum of 5 year warranty.
- Luminaire arms connected to existing wood poles will have provisions for typical wood anchors

2.02 LIGHT FIXTURES

Residential: Shall be Halophane Utility Post Top fixture. See Sandy City Standard Detail SL-02.

Arterial: Shall be American Electrical Lighting Fixture. See Sandy City Standard Detail SL-05.

2.03 CONDUIT

- A. Conduit shall be two inch (2") schedule 40 gray electrical PVC.
- B. All joints shall be glued and all open ends shall have duct seal or approved cap.
- C. HDPE conduit will be allowed if it is 2" schedule 40 and gray in color.
- D. Maximum depth of conduit shall be no more than 30".

2.04 WIRE

- A. Wire shall be #8 stranded AWG copper.
- B. Wire shall be color coded black, white, and green or numbered for identification.
- C. Insulation can include XLP USE, THHN, THWN, RHH or RHW insulation.
- D. No more than six (6) street lights shall be linked from one power source. Any exception shall be approved by Sandy City Public Utilities.
- E. #12 AWG copper wire (min) will be allowed from the light fixture to the first connection in the hand hole of the pole.
- F. Aluminum wire shall not be allowed.

2.05 WIRE CONNECTIONS

- A. Wire connections in the hand hole shall be water tight.
- B. Residential streetlights shall have a water tight, in line, fuse holder in the junction box near the base of the pole.
- C. Arterial streetlights shall have a water tight, in line, fuse holder inside the hand hole of the pole.
- D. Non-grounding connections in the junction box shall be individually insulated and water tight.
- E. A continuous ground wire shall extend from the pole to the point of disconnect junction box near the power source.

2.06 VOLTAGE

Voltage shall be 120 Volt. Any voltage over 120 shall be approved by Sandy City Public Utilities.

2.07 FUSE

- A. All fuses shall be time delayed, class M (Midget) style, rated at 250 volts.
- B. Fuse near the light fixture shall be between 5 and 10 amps. This shall be in the junction box at the base of the pole for residential streetlight or in the hand hole of the light pole for arterial lighting or in the fixture on existing pole.
- C. A 30 amp (maximum) fuse shall be used in the point of disconnect junction box within four (4) feet of the power source. See Sandy City Standard Detail SL-09.

2.08 GROUNDING AND BONDING

- A. All grounding shall be installed according to the current edition of the NEC Section 250.
- B. Aluminum to copper mechanical lugs shall be used to connect the ground wire to the grounding provision inside the hand hole opening of the pole.
- C. A continuous ground wire shall extend from the pole to the point of disconnect junction box near the power source.
- D. One eight (8) foot long, 5/8" diameter copper coated steel ground rod shall be placed in every arterial streetlight junction box.
- E. One eight (8) foot long, 5/8" diameter copper coated steel ground rod shall be placed in the point of disconnection junction box.

2.09 JUNCTION BOXES

Residential

- A. Junction boxes shall be High Density Polyethylene (HDPE). See drawing SL-03 for details.
- B. "Street Lighting" shall be molded in the lid.
- C. Residential junction box shall not be used in concrete, asphalt, or vehicular traffic situations.
- D. Polymer concrete with a tier 22 rating shall be used in all other applications. See Sandy City Standard Detail SL-08.

Arterial

- A. Junction boxes shall be polymer concrete with a tier 22 rating. See drawing SL-08 for details.
- B. Junction box shall have Sandy City's logo and "Street Lighting" cast in the lid from the manufacturer.

2.10 WARRANTY

All residential and arterial street light poles shall have a 5 year minimum warranty.

PART 3 - EXECUTION

3.01 COORDINATION

- A. Developer shall notify a Public Utilities Inspector two (2) working days prior to beginning Street Light construction.
- B. Rocky Mountain Power will connect the street light to a junction box or transformer. Contractor shall supply buried wire to power source plus three (3) feet, as required (see Standard Detail SL-09, RMP Street Light Point-of-Disconnect Diagram).
- C. Sandy City will notify Rocky Mountain Power and request the light be energized upon approval from the Sandy City Public Utilities Inspector. No bond will be released until the light is fully functional and the I.D. number is on the pole.

3.02 INSTALLATION

- A. Street Light poles shall not be within four (4) feet of water valve and ten (10) feet of fire hydrants.
- B. Installation of Street Light poles within close proximity of trees, mailboxes, and utilities shall be avoided unless approved by Sandy City Utilities.
- C. Street Light Pole shall be set plumb. The pole shall be installed within 1/4 degree of vertical.
- D. Photocells shall be oriented to the north. Confirm that Street Light fixture is oriented appropriately with street side toward street.
- E. On all residential Street Lights, a minimum of two (2) bags of 80 pound concrete mix shall be used. A minimum of twelve (12) inch diameter hole shall be provided for the installation of the street light pole. Pole shall be centered in hole and plumb. Fill the hole with concrete to within two (2) inches of wire hole, but not above. Post mix is not acceptable. Concrete forms such as saunatube are not permitted.
- F. For Residential Street Light Installation, refers to Sandy City Standard Details SL-01, 02, 03, and 09.
- G. For Arterial Street Light Installation, refers to Sandy City Standard Details SL-04, 05, 06, 07, 08, and 09.

END OF SECTION